Sept. 20, 1971 E. M. WILLENBACHER ET AL 3,605,662

UPPER FEED MECHANISM

Filed May 1, 1970 4 Sheets-Sheet 1

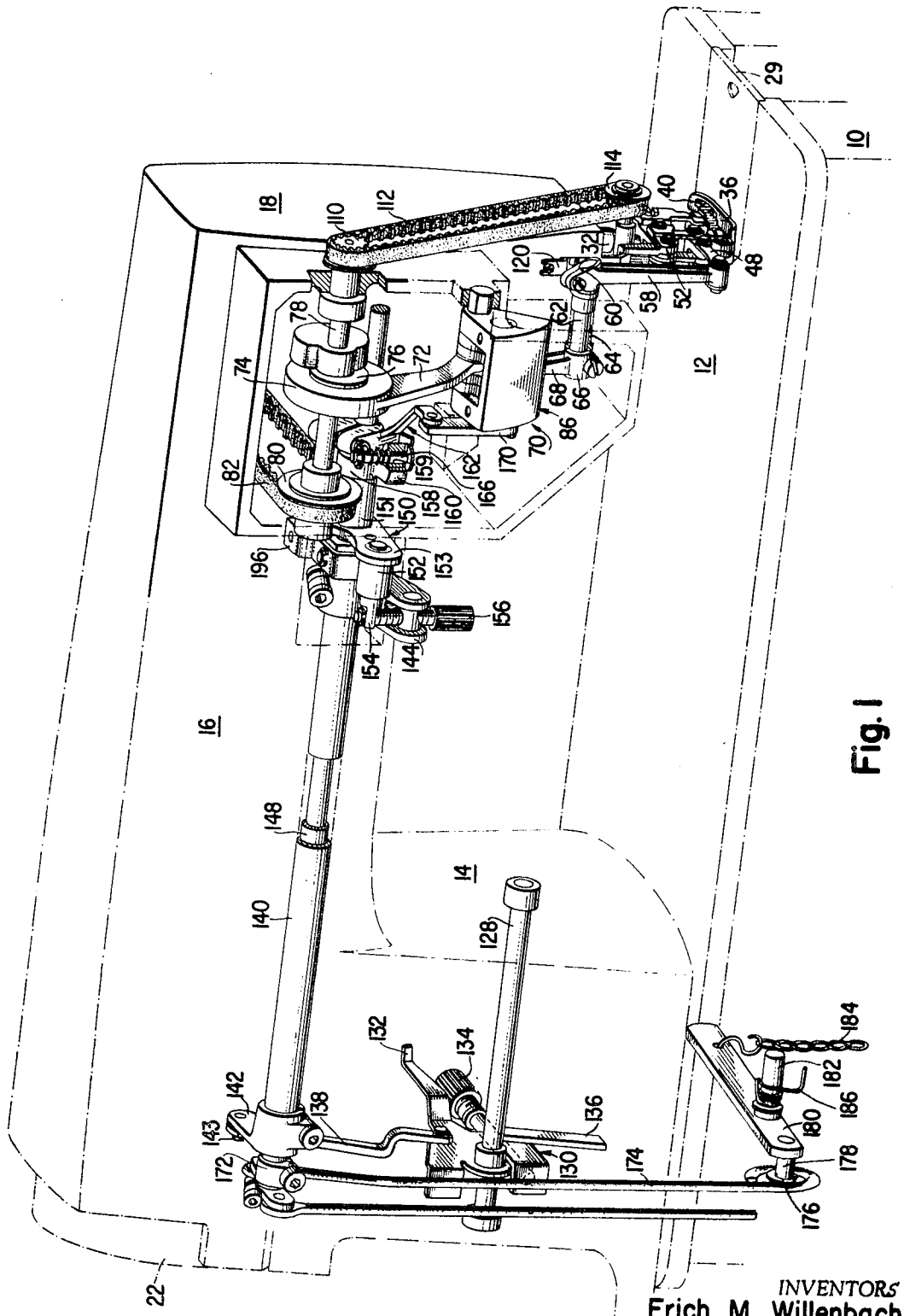

Fig. 1

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4 Sheets-Sheet 2

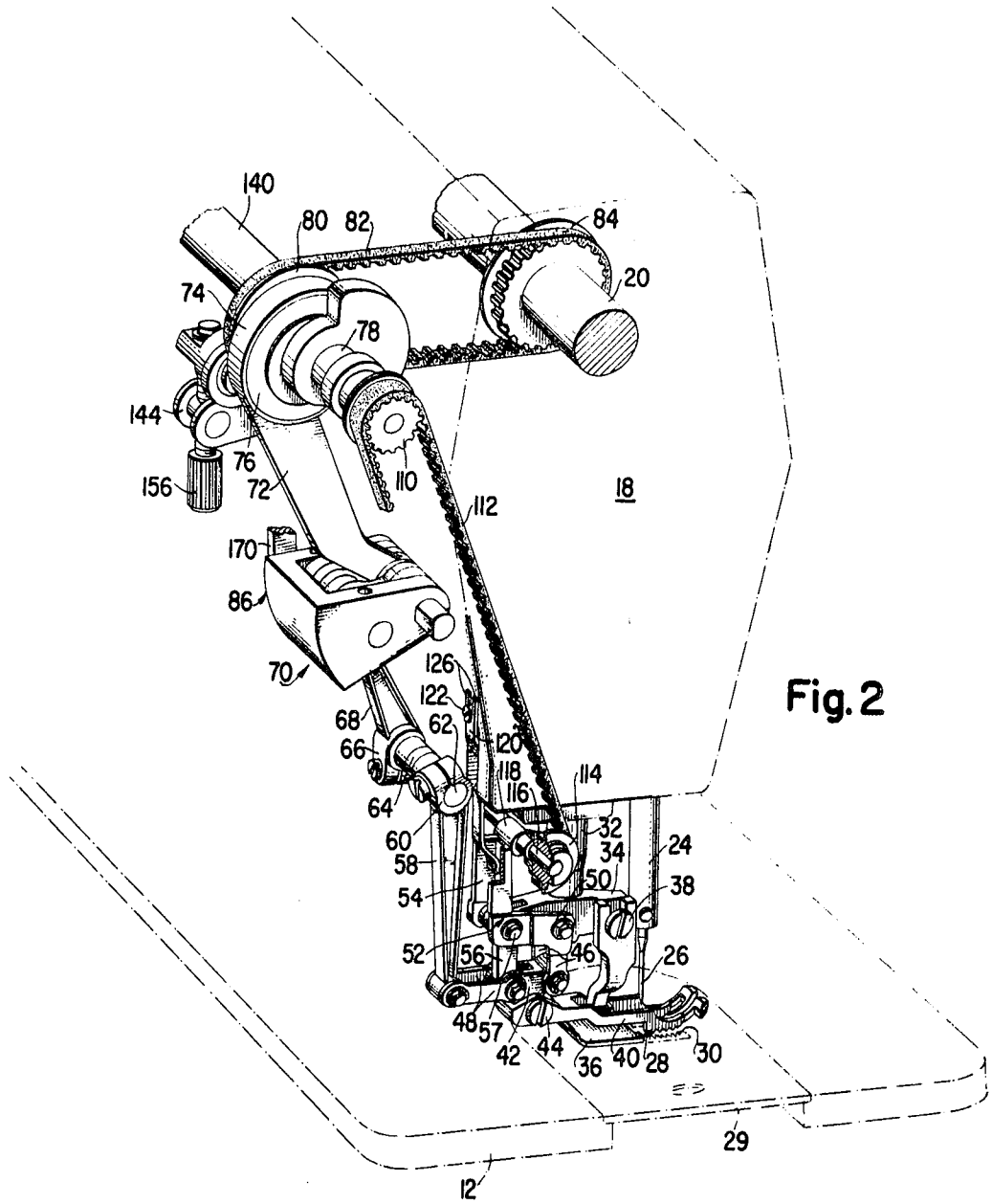

Fig. 2

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UPPER FEED MECHANISM

Filed May 1, 1970 4 Sheets-Sheet 3

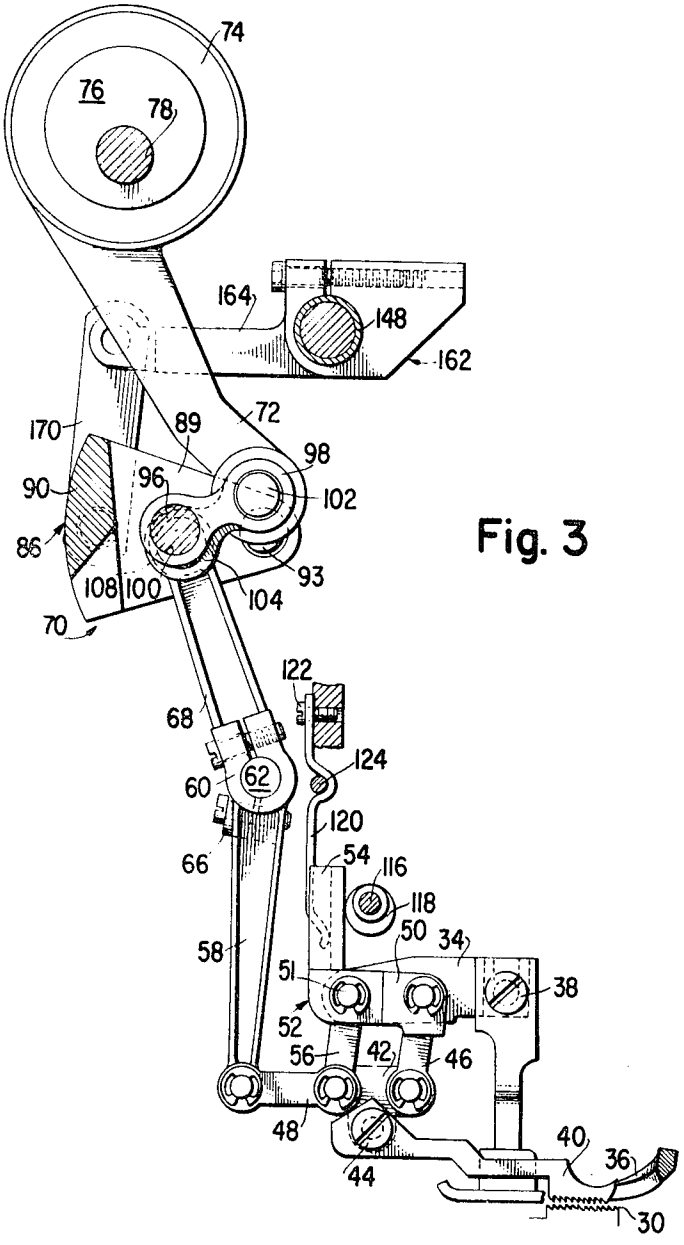

Fig. 3

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UPPER FEED MECHANISM

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4 Sheets-Sheet 4

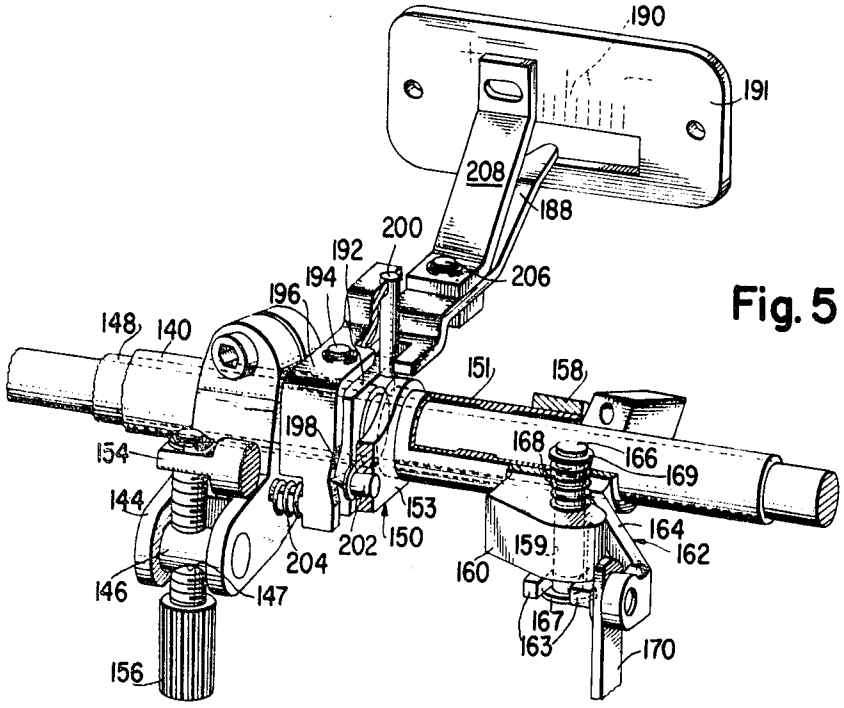

Fig. 5

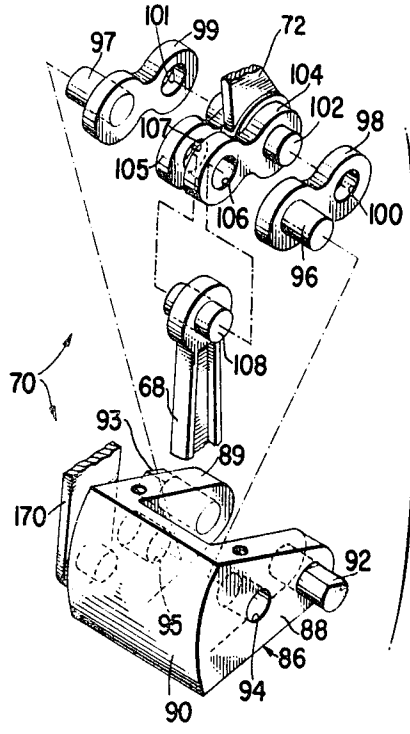

Fig. 4

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3,605,662

UPPER FEED MECHANISM

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Int. Cl. D05b 27/04
U.S. Cl. 112—212 19 Claims

ABSTRACT OF THE DISCLOSURE

A sewing machine having an upper feed mechanism adapted to be used independent of or in conjunction with a conventional lower feed. The upper feed dog is given advance and return movement through a quadratic linkage which is rocked by a pair of rocker arms driven through a regulating member from an eccentrically oscillated pitman. A timing belt transmits motion from the shaft to a shaft on which the pitman eccentric is mounted. This latter shaft also mounts a second timing belt which drives a second eccentric to give lift and dropping movement to the upper feed dog. The regulating member may be adjusted to change the upper feed either simultaneously or independently of the lower feed mechanism by either of two regulating screws operating through a plurality of cranks and couples mounted on a pair of concentric shafts. A foot pedal operated linkage turns the inner of the two shafts, independently of the two regulating screws, to effect a quick change of the upper feed only for as long as the pedal is depressed, returning the upper feed to its present amount upon release thereof. An indicator scale and pointer show the difference in feeds between bottom and top feed dogs as set by the regulating screw that changes the upper feed only.

BACKGROUND OF THE INVENTION

This invention relates to sewing machines and more particularly to an upper work feeding mechanism therefor having a work feeding foot adapted to operate on the top ply of material being sewn to advance the material past the stitch forming instrumentalities and which may be adapted to operate in conjunction with a conventional bottom feed mechanism operating on the bottom ply of the work.

In order to obtain a uniform work feeding action, so as to prevent gathering or stretching of one ply of work relative to the others, it is known in industrial type sewing machines which operate on two or more plies of fabric, to impart a feeding movement to both the top and bottom work surfaces by means of two separate feeding members. These members, known in the art as feed dogs, preferably include a plurality of teeth which act upon the surface of the work when the needle is withdrawn therefrom to feed the work in the preferred direction to and from the stitching point. Because the presser foot under some conditions exerts a retarding force on the top ply, and because when sewing plies of different materials together there may be a different feeding rate applied to the different materials by the feed dogs acting thereon, it is desirable to adjust the feed of the top and bottom feed dogs independently to obtain the same feed on all the plies. This is also necessary when it is desired to obtain a gathering or stretching of one ply relative to the others. Furthermore, once the relative feed rates for the top and bottom feed dogs are properly adjusted and a change in stitch length of the entire work is required it is desirable to simultaneously adjust both the top and bottom feeds without changing the relative feeds so that there is a minimum of time lost in changing the sitch length. Moreover, during certain operations, such as during straight stitch sewing without a stretching or gathering action, it may be necessary to effect a variation, such as a gathering, during a small portion of the cycle. For this purpose it is of course desirable to effect such an operation without changing the previous setting of the feed dogs and to be able to come back to the normal conditions rapidly and without any readjustments. These desirable features are geared to a high speed sewing operation which must not be sacrificed for the sake of simplicity in control. The prior art has not provided the high speed capability in a sewing machine having an upper feed mechanism, and especially in such a machine having the aforesaid control features in combination with an upper feed.

SUMMARY OF THE INVENTION

It is, therefore, a primary object of this invention to provide in a sewing machine an improved upper feed mechanism adapted for high speed operation, and which may be used in conjunction with a conventional lower feed.

A further object of this invention is to provide, in a sewing machine having a lower feed dog, an improved upper feed mechanism which may be adjusted simultaneously with the lower feed dog to regulate the stitch length being sewn.

A still further object of this invention is to provide, in a sewing machine having a lower feed dog, an improved upper feed mechanism which can be adjusted independently of said lower feed to change the rate of feed of the top work plies without effecting the feed of the lower work plies, and which can also be adjusted to change the lower feed mechanism together with the upper feed.

A yet still further object of this invention is to provide in a sewing machine an upper feed mechanism for use in conjunction with a lower feed mechanism which is compact and may be installed on existing lower feed sewing machines.

Another object of the present invention is to provide in a sewing machine having a lower feed, an upper feed mechanism having means for rapidly effecting a difference between the upper and lower feed rates and returning the feed rates to the previous condition.

These and other objects are achieved by providing, preferably in a sewing machine having a conventional lower feed mechanism, an upper feed mechanism comprising a quadratic linkage supported upper feed dog which is given feed advance and return motion by an eccentric drive element which operatively is connected to the arm shaft of the machine and is also operatively connected to the quadratic linkage by rocker arm means. For quiet high speed operation the eccentric drive element is driven by a belt from the arm shaft. A toggle type regulating mechanism, interposed between the eccentric drive element and the rocker arm means, is operatively connected to a first control shaft whose angular setting is effected by a manually adjustable regulator screw operatively coupled to a shifting lever mounted on the first control shaft to change independently the upper feed advance and return motion, and hence the upper feed relative to that of the lower feed. A second control shaft, which is operatively coupled to the first control shaft to turn the same, is angularly effected by a second manually adjustable regulating screw which is further interconnected to the lower feed mechanism so that when the second regulating screw is turned both the upper and lower feed dog motions are simultaneously effected. To effect a rapid difference between the upper and lower feeds and for returning the feeds to their prior settings there is provided a foot pedal operatively

connected to a crank on the first control shaft. When the pedal is depressed the first control shaft is temporarily disengaged from the regulating screws and is turned to effect the upper feed relative to the lower feed. When the pedal is released the first shaft returns to its initial position as determined by the two regulating screws. Lift and fall motion of the upper feed dog is obtained by an eccentric operatively driven from the arm shaft and is operatively connected to the feed dog. This eccentric is also driven by a belt operatively connected to the arm shaft and acts against a bellcrank to give lift to the feed dog while a spring biases the bellcrank to provide the dropping action of the feed dog.

BRIEF DESCRIPTION OF THE DRAWINGS

For a fuller understanding of the nature and objects of this invention reference should be had to the following description taken in conjunction with the accompanying drawings in which:

FIG. 1 is a rear perspective view of a position of a sewing machine incorporating the preferred embodiment of the upper feed mechanism of the present invention with portions thereof broken away, cross sectioned and shown in phantom to clearly show the mechanism;

FIG. 2 is an end perspective view of a portion of the sewing machine illustrated in FIG. 1 with portions thereof broken away, cross sectioned and shown in phantom;

FIG. 3 is an elevational view of a portion of the feed advance and return mechanism of the present invention with parts thereof removed and portions thereof cross sectioned to illustrate clearly the feed linkages;

FIG. 4 is a partially disassembled perspective of the upper feed regulating member illustrating the elements by which the upper feed may be controlled; and

FIG. 5 is a partially cross sectioned and broken away perspective of a portion of the mechanism of this invention showing the coupling mechanisms by which the upper feed may be varied either together with or independent of any lower feed mechanism, and further showing apparatus through which the difference between the upper and lower feeds may be indicated.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to the drawings, wherein like numerals designate similar parts, an embodiment of the present invention is disclosed applied to a sewing machine having a frame comprising a bed **10** having a horizontally disposed work supporting surface **12** from one end of which rises a standard **14** supporting a bracket arm **16** overhanging the bed and terminating at its free end in a hollow head **18**. Journaled lengthwise within the bracket arm, as shown in FIG. 2, is a main shaft **20** which drives all the moving parts of the sewing machine and which is rotated by means of a fly wheel **22** from any suitable source of power. Reciprocably mounted in bearings in the bracket arm head and reciprocated by suitable connections (not shown) to the main shaft, is a needle bar **24** carrying, at its lower end, a thread carrying needle **26** which cooperates with a suitable loop taker (not shown) mounted within the bed **10** below the surface **12** and driven through suitable connections to the main shaft in timed relationship with the needle to form stitches at a stiching point **28** in the throat plate **29**. The disclosed machine also includes a conventional lower feed mechanism including a lower feed dog **30** preferably having two sets of teeth and which is adapted to be given lateral feed advance and return movement transverse to the major axis of the bracket arm, and vertical movement by conventional four-motion means (not shown) driven from the main shaft **20**. A conventional lower feed mechanism of this type is disclosed in U.S. patent to Van Ness No. 2,848,964 issued Aug. 26, 1958. Reciprocably mounted in the head **18** is a spring biased presser bar **32** carrying at its lower end a block **34** to which is adjustably secured a conventional presser foot **36** by means of a head screw **38**.

Above the throat plate **29** overlaying the lower feed dog **30** is an upper feed dog **40** preferably having two sets of teeth adapted to cooperate with the lower feed dog to feed work material to and from the stitching point. The upper feed dog is firmly secured to a forked member **42** by means of screw **44** so as to move therewith. Pivotably secured by conventional means to the member **42** at opposite ends of each outer surface thereof are two pair of links **46** and **48**. The links **46** are each further pivotably secured at their respective free end to one bifurcated leg **50** of a bellcrank **52** having a channel shaped leg **54** and a pair of bifurcated legs **50**. The bifurcated legs **50** fit about side walls of the block **34** and are pivotally secured thereto by conventional means indicated as **51**. Of course, the pivot point **51** may be on the frame of the machine instead of on the presser foot block, but with the present arrangement when the presser bar raised, the upper feed dog is raised along with the presser foot. Formed in the bellcrank end of block **34** is a milled slot within which a link **56** is positioned and pivotally mounted on the means pivotally securing the bellcrank **52** to the block **34**. The other end of link **56** is fitted within the crotch of the forked member **42** and is pivotably mounted therein by the means pivotally securing the links **48** thereto. Each link **48** is further pivotally secured at its other end to one end of a rocker arm **58** which is secured at its other end by means of an integral C-clamp **60** to a rock shaft **62** journaled in a bushing **64** in the frame. It should be observed that the linkage comprising the bellcrank legs **50**, the links **46** and **56** and the member **42** form a quadratic linkage (links **46** and **56** are the same length, as are legs **50** and **42**) pivotable about **51** when the rocker arm **58** is given a rocking motion by the shaft **62** as will hereinafter be described. The upper feed dog is thus given a fed advance and return rocking movement by the motion of the arm **58**. Vertical component of motion required to give the upper feed dog the necessary "four motion" action, as is known in the art, is supplied by means hereinafter described.

Secured to the free end of rock shaft **62** by an integral C-clamp **66** is a second rocker arm **68** which is connected to and rocked by a toggle type feed regulating member generally indicated as **70**, and which will be further described as this discussion proceeds. It should be noted that the rocker arms **58** and **68** and the rock shaft **62** act as a single rocker arm. The member **70** receives its input, as will be explained below, from one end of a pitman **72** whose other end comprises a sleeve or strap **74** surrounding an eccentric **76** which is secured to auxiliary shaft **72** journaled in the rear of the sewing machine head. Also secured to the shaft **78** is a grooved pulley **80** which meshes with a toothed timing belt **82** and thereby receives power from another grooved pulley **84** fast on the main shaft **20** and with which the belt **82** also meshes. Thus, the auxiliary shaft **78** is driven in timed relationship with the main shaft **20** and with the reciprocation of the needle bar **24**.

Referring to FIGS. 3 and 4, the regulating member **70** will now be described. The member **70** comprises a carrier frame **86** of any suitable configuration, but here illustrated as including two substantially isosceles triangular end walls **88** and **89** spaced from one another at the side opposite the apex by a convex wall **90**. Located adjacent the apex of each wall **88** and **89**, on the exterior surface thereof, is a respective pin **92** and **93** secured to the respective wall at one end and journaled to turn in the frame at their free ends. The internal surface of each wall **88** and **89** includes a respective hole **94** and **95** within which is journaled a respective pin **96** and **97** each of whose other end is preferably press fitted into a hole in a respective link **98** and **99**. Spaced from the respective pins **96** and **97** in each link **98** and **99** is a

respective hole **100** and **101** within which is pournaled a pin **102**. The pin **102** is preferably press fitted within a hole (not shown) in the free end of pitman **72** and further passes through a pair of links **104** and **105** which are journaled to turn thereon. The links **104** and **105** are similar to links **98** and **99** and include respective holes **106** and **107** spaced from the center line of pin **102** by the same distance as the holes **100** and **101** are spaced from the center lines of the respective pins **96** and **97**. Within each hole **106** and **107** is journaled a pin **108** which is preferably press fitted within a hole in the free end of rocker arm **68**. It should be evident from the kinematics of the regulating member **70** that the oscillating motion of pitman **72** is transformed into a rocking motion at the rocker arm **68** when the center line of pin **108** is not coaxial with the center lines of pins **96** and **97**, and that the further the center line of pin **108** is from the center lines of pins **96** and **97** the greater will be the rocking motion imparted to the arm **68**, and through the mechanism described above, the greater will be the feed advance and return motion imparted to the upper feed dog **40**. The means for changing the spacing between the center of pin **108** and pins **96** and **97** will hereinafter be described. It should, however, be noted that only one of the two links **98** and **99**, and only one of the links **104** and **105** are kinematically required.

In to provide the proper vertical displacement of the upper feed dog, so that the feed dog does not interfere with the work during the time that the needle is in the work, there is provided on the end of the shaft **78** a grooved pulley **110** which drives, by means of a meshing toothed timing belt **112**, another grooved pulley **114** mounted on the end of a short stud shaft **116** journaled in the bottom of the machine head just above the feed dog **40**. Secured to the shaft **116**, in a position adjacent the leg **54** of the bellcrank **52**, is an eccentric **118**. A leaf spring **120**, secured to the head **18** by a head screw **122**, biases the leg **54** against the eccentric **118**, and thus biases the bellcrank in a clockwise direction, as viewed in FIGS. 2 and 3. The spring **120** therefore acts to force the feed dog **40** downwardly against the work. A peg **124** aids the biasing power of the spring by pretensioning the same while the forked end **126** of the spring and the screw **122** allow for adjustment of the biasing pressure. It should be clear that during its return movement, the upper feed dog **40** is lifted by the rotating eccentric which pushes the leg **54** of the bellcrank clockwise in FIGS. 2 and 3 against the force of spring **120**. Since the motions of the upper feed dog and the conventional lower feed dog **30** are derived from the rotation of the main shaft **20**, they may operate together in a synchronous fashion by properly positioning the eccentrics **76** and **118**.

To change the feeding rate of the upper feed dog **40** there are provided three control features: the first allows for simultaneously changing the upper and lower feeds; the second allows the upper feed to be changed relative of the lower feed; the third give the capability while sewing to change, for as long as desired, the upper feed relative to the lower feed, and then to return the upper feed to its previous setting. Each of these control features will now be described in order.

Journaled on a stud shaft **128** in the standard **14** is an indicator bracket **130** having a pointer **132** projecting toward the front of the standard. The bracket **130** is biased by a spring (not shown) against a regulating screw **134** threaded into the front of the standard and available for engagement by an operator. Pivotally mounted on the bracket **130** are a pair of levers **136** and **138**. The lever **136** is connected to the mechanism (not shown) which regulates the feed of the lower feed dog **30**, while lever **138** regulates the upper feed dog **40** as will be presently described.

Journaled in the bracket arm **16** of the sewing machine is a hollow shaft **140** having a crank **142** secured to the standard end thereof. The lever **138** is mounted on a crankpin **143** of the crank **142** to thus angularly turn the shaft **140** when the screw **134** is rotated. As best illustrated in FIGS. 1 and 5, a crank **144** having an integral C-clamp is secured to the shaft **140** adjacent its other end. The crank **144** includes a bifurcated crank arm, between the tines of which is pivotally mounted a pin **146** having a threaded hole **147** transverse to the axis of the pin. A second hollow shaft **148**, concentric with and passing through the hollow shaft **140**, is further journaled within the bracket arm **16**. The shaft **148** is longer than shaft **140** and has freely journaled thereon, at a location beyond the head end of shaft **140**, a crank element **150** including two substantially parallel bushings **151** and **152** connected by an integral plate or link **153**. The shaft **148** freely passes through bushing **151** while a pin **154** pass through bushing **152** and is pivotally secured to the plate **153**. At the end opposite the plate **153** the pin **154** includes a threaded hole (not shown) transverse to its major axis. A regulating screw **156** having an operator engageable portion, whose adjustment purpose will hereinafter be described, is threadedly received within the hole **147** in pin **146** and within the hole in pin **154** thus effectively coupling the crank **150** to the shaft **140**. Secured to the bushing **151** as by a press fit, so as to turn therewith, is a further crank **158** having a bore **159** formed in its crank arm **160**. Fast on the shaft **148** as by an integral C-clamp is a shifting lever **162** including a slotted ear **163** and a crank arm **164**. A pin **166** having a disk shaped head **167** extends through the slotted ear **163** with the head **167** abutting the bottom surface thereof. The pin **166** registers with and passes completely through the bore **159** so that a portion thereof projects above the arm **160**. A coil spring **168** is fitted about the projecting portion of the pin and is secured in position by an abutting lock washer **169** or other such means at the projecting end of the pin. It should be clear that the crank arm **160**, the shifting lever **162**, the pin **166** and the spring **168** act as a clutch type of coupling unit to couple the shaft **148** to the crank element **150**, and thus to the shaft **140**. The crank arm **164** of the shifting lever **162** is bent at its free end and pivotally connected to one end of a lever **170** whose other end is pivotally connected to the exterior wall **89** of the feed regulator carrier frame **86** at a location remote from the pin **93**. Movement of the lever **170** thus results in a pivoting of the feed regulator **70** about the journal pins **92** and **93** thereby changing the spacing of pins **96** and **97** relative to pin **108**, and, as described above, this results in a change in feed advance and return motion of the upper feed dog.

Thus, to change the stitch length of both the top and bottom feeds, the operator thus merely turns the screw **134** so as to position the pointer **132** at the selected stitch length indicia (not shown) on the front of the standard **14**. This causes a pivoting of the element **130** and the levers **136** and **138**. The lever **138** turns shaft **140**, and through the mechanism described above, turns the regulator **70** through the proper angle to change the feed of the upper feed dog **40**. Simultaneously, the lower feed dog **30** has its feed changed through the input of lever **136** to its conventional mechanism which includes the lever **136**, the indicator **130** and the screw **134**.

To change the upper feed independently of the lower feed, the regulating screw **156** is turned, thus resulting in a change in the angular relationship between crank **144** and crank **150**. This, of course, changes the angular relationship between shaft **148** and shaft **140**, i.e., shaft **148** is turned while shaft **140** remains in the position set by screw **134**. Since shaft **148** is turned, the regulator **70** is pivoted and the upper feed only is varied; the lower feed is not effected since the lever **136** is not moved.

During certain sewing operations it may be desirable to effect a change in the upper feed relative to the lower feed while the machine is operating and to then return the

feeds to their original conditions. One such operation would be during sewing with a balanced feed and a gathering of the upper material relative to the lower material is desired. The present mechanism allows for such an operation. Secured to the standard end of shaft **148** is a crank **172** to the arm of which is pinned the upper end of a rod **174**, whose lower end is wrapped about a grooved pulley **176**. The pulley is mounted on a stud shaft **178** which is secured to one end of a lever **180** and is pivotally mounted between its extremities on a shaft **182** secured to the sewing machine frame under the bed **10**. The free end of the lever **18** is connected to one end of a chain **184** whose other end mounts a foot pedal (not shown).

To effect a difference in feeds, the foot pedal is depressed causing the lever **180** to pivot about shaft **182** and the shaft **148** to turn counterclockwise as seen in FIG. 3. This results in a disengagement of the shifting lever **162** from the crank **158** as the turning of shaft **148** overcomes the force of spring **168**, so that the crank element **150** is not turned. This action moves the lever **170** and hence the regulator **70** and the upper feed dog without changing the angular relationship between bushing **151** and shaft **140**. When the foot pedal is released a spring **186** returns the lever **180** to its normal position and hence the shaft **148** is returned to its predepression angle. The spring **168** returns the lever **162** to its original coupled position with crank **158**.

The difference in feeds between the upper and lower feed dogs may be indicated by a pointer **188** on a graduated scale **190** on a bracket **191** mounted on the front of the standard **16**. Fast on the shaft **140** is a mounting block **192** in which is secured a stud **194**. A lever **196** is pivotably mounted on the stud **194** so as to turn relative thereto. The lever **196** includes a downwardly extending arm having a cam surface **198** formed therein and another arm in which is secured a pin **200**. A cam follower pin **202** secured in the cross portion **153** of crank **150** is adapted to engage the cam surface **198** by the biasing action of a spring **204** mounted on the downwardly extending arm of the lever **196** acting against the crank **144**. The pointer **188** is pivotally mounted intermediate its ends on a pin **206** secured to a mounting bracket **208** whose free end is secured to the bracket arm **16** of the sewing machine. The tail end of the pointer is forked shaped and is adapted to receive the pin **200** between its tines. When the regulating screw **156** is turned a change in the angular relationship between the crank **144** and the crank element **150** occurs. Thus, the cam follower pin **202** moves in the cam surface **198** causing the lever **196** to turn on the stud **194**, and the pin **200** engages the forked end of the pointer to pivot the pointer accordingly. When the basic stitch length is changed by screw **134**, i.e., both the upper and lower feeds are changed, the crank element **150** and the mounting block **192** are moved synchronously, so that the follower pin **202** remains in the same relative position on the surface of lever **196** and the pin **200** merely moves vertically in the forked end of the pointer, allowing the pointer to remain in the position previously determined by the screw **156**. The scale **190** may be graduated from plus (+) to minus (—), wherein the plus indicates gathering of the upper material and the minus indicates stretching of the upper material relative to the lower material.

Although the present invention has been illustrated and described with respect to particular embodiments, e.g. a machine having a lower feed dog rather than merely a surface against which the upper feed dog may operate, modifications thereof will occur to those skilled in the art. It is to be understood that this invention is not to be limited to the particular details disclosed, but that all modifications within the spirit and scope of the invention as defined by the appended claims are intended to be protected.

Having thus set forth the nature of the invention, what we claim herein is:

1. In a sewing machine comprising a frame including a bed having a work support, a standard rising from one end of the work support, a bracket arm at the top of the standard overhanging the work support and terminating in a sewing head, a drive shaft rotatably mounted lengthwise in said bracket arm, means for rotating said drive shaft, a needle mounted in said head for endwise reciprocation in timed relation to said drive shaft into and out of work engaging positions at a stitching point, a lower feed dog mounted in said bed below the work support for advancing work to said stitching point in timed relation to said needle reciprocation, and an upper feed dog mounted above said work support overlying said lower feed dog for cooperating with said lower feed dog to advance the work, wherein the improvement comprises: an auxiliary shaft rotatably mounted in said frame, a first flexible drive means operatively coupling said auxiliary shaft to said drive shaft for rotating said auxiliary shaft in a timed angular relation therewith, a pitman, means mounted on said auxiliary shaft for oscillating said pitman in timed relation to the rotation of said auxiliary shaft, a rocker arm, means operatively connecting said pitman to said rocker arm to impart a rocking motion to said arm, linkage operatively connecting said rocker arm to said upper feed dog for rocking the same to provide feed advance and return motion thereto in timed relation with said lower feed dog, a stud shaft rotatably mounted in said frame, eccentric means fast on said stud shaft, and a second flexible drive means operatively coupling said stud shaft to said auxiliary shaft for rotating said stud shaft in a time angular relation therewith, said eccentric means operatively engaging said linkage to impart a lifting and dropping motion to said upper feed dog in time relation to the reciprocation of said needle and its feed advance and return movements.

2. In a sewing machine as recited in claim **1** wherein said first flexible drive means comprises a pulley mounted on said drive shaft for rotation therewith, a first pulley mounted on said auxiliary shaft for rotation therewith, each of said pulleys having notches formed in the periphery thereof, and a continuous timing belt having teeth formed on the inner surface thereof and mounted about said drive shaft pulley and said first pulley with the teeth in meshing engagement with said notches, said second flexible drive means comprises a second pulley mounted on said auxiliary shaft for rotation therewith, a pulley mounted on said stud shaft for rotation therewith, each of said pulleys having notches formed in the periphery thereof, and a continuous timing belt having teeth formed on the inner surface thereof and mounted about said stud shaft pulley and said second pulley with the teeth in meshing engagement with said notches.

3. In a sewing machine as recited in claim **1** wherein said means operatively connecting said pitman to said rocker arm comprises an upper feed regulating member, said member comprising a carrier frame pivotally mounted in said sewing machine frame, first link means pivotably secured at one extremity to said pitman and at a second extremity to said rocker arm, second link means pivotably secured at one extremity to said pitman and at a second extremity to said rocker arm, second link means pivotably secured at one extremity to said pitman and at a second extremity to said carrier frame, and means for pivoting said carrier frame in said sewing machine frame to change the position of the second extremity of the second link means relative to the second extremity of the first link means, thereby changing the stroke of said rocker arm and said upper feed dog advance and return movements.

4. In a sewing machine as recited in claim **2** wherein said means for oscillating said pitman comprises an eccentric mounted on said auxiliary shaft for rotation therewith, said pitman including an eccentric strap surrounding the periphery of said eccentric to be oscillated thereby, said linkage connecting the upper feed dog to said rocker

arm including a quadratic link mechanism, said upper feed dog being secured to a first of said links, said first link being pivotably secured to a second and to a third of said links, a bellcrank lever, each said second and third links being further pivotably secured to one arm of said bellcrank lever, the second arm of said lever being biased into engagement with said stud shaft eccentric.

5. In a sewing machine as recited in claim 4 including a presser bar mounted in said head for selective endwise translation, a block mounted on said presser bar, said bellcrank being pivotably mounted to said block at the juncture of said second link, said rocker arm being operably connected to said first and second links at the juncture thereof so as to rock said linkage about said bellcrank pivot.

6. In a sewing machine as recited in claim 5 wherein said means operatively connecting said pitman to said rocker arm comprises an upper feed regulating member, said member comprising a carrier frame pivotably mounted in said sewing machine frame, first link means pivotably secured at one extremity to said pitman and at a second extremity to said rocker arm, second link means pivotably secured at one extremity to said pitman and at a second extremity to said carrier frame, and means for pivoting said carrier frame in said sewing machine frame to change the position of the second extremity of the second link means relative to the second extremity of the first link means, thereby changing the stroke of said rocker arm and said upper feed dog advance and return movements.

7. In a sewing machine as recited in claim 3 wherein said means for pivoting said carrier frame comprises a first shaft journaled in said bracket arm, a shifting lever fast on said shaft, means operatively connecting said shifting lever to said carrier frame for pivoting the same in said sewing machine frame when said shaft is turned, and means for turning said shaft.

8. In a sewing machine as recited in claim 7 wherein said means turning said shaft comprises a crank secured to said shaft, a rod operably connected at one end to said crank, a lever pivotably connected to the sewing machine frame intermediate its extremities, the other end of said rod being operably connected to one extremity of said lever, and operator engageable means connected to a second extremity of said lever for selectively pivoting said lever to thereby turn said shaft.

9. In a sewing machine as recited in claim 7 wherein said means for turning said first shaft comprises a second shaft journaled in said bracket arm, said second shaft being concentric with and overlaying said first shaft, means coupling said second shaft to said shifting lever to move the same when said first shaft is turned, a crank mounted on said second shaft, a bracket pivotably mounted in said frame, a lever operably connected to said crank and to said bracket to turn said second shaft when said bracket is pivoted, a second lever operably connected to said bracket and adapted to operably engage said lower feed dog, and an operator influenced regulating screw mounted in said frame in a location adjacent said bracket, said bracket being biased to engage the end of said screw such that rotation of said screw pivots said bracket, thereby simultaneously regulating the upper and lower feed dogs.

10. In a sewing machine as recited in claim 9 wherein said means coupling said second shaft to said shifting lever comprises a crank secured to said second shaft, a crank element including a bushing journaled on said first shaft, a second regulating screw mounted on said crank and threadedly received in said crank element at a location radially removed from said shafts to couple said crank to said crank element, a crank arm fast on said bushing, and means coupling said crank arm to said shifting lever, whereby said first shaft may be turned by rotation of said first or said second regulating screw, rotation of said second regulating screw regulating the upper feed dog independently of said lower feed dog.

11. In a sewing machine as recited in claim 10 wherein said means coupling said crank arm to said shifting lever comprises a resilient coupling including a pin extending axially through an aperture in a portion of said arm and through an aperture in a portion of said lever, said pin having means on one end thereof for preventing said pin from fully passing through said apertures, said pin having an axial dimension greater than the combined thickness of said portions such that part of said pin projects out from said portions when said one end is flush with one of said portions, a spring coiled about said projecting part of said pin, and means on the other end of said pin abutting said spring for securing said spring to said pin.

12. In a sewing machine as recited in claim 11 including a crank secured to said first shaft, a rod operably connected at one end to said crank, a lever pivotably connected to the sewing machine frame intermediate its extremities, the other end of said rod being operably connected to one extremity of said lever, and operator engageable means connected to the second extremity of said lever for pivoting said lever to thereby turn said first shaft, whereby said shifting lever decouples from said crank arm and said carrier frame may be selectively pivoted without effecting the position of said first and second regular screws.

13. In a sewing machine comprising a frame including a bed having a work support, a standard rising from one end of the work support, a bracket arm at the top of the standard overhanging the work support and terminating in a sewing head, a drive shaft rotatably mounted lengthwise in said bracket arm, means for rotating said drive shaft, a needle mounted in said head for endwise reciprocation in timed relation to said drive shaft into and out of work engaging positions at a stitching point, and an upper feed dog mounted above said work support for advancing work to said stitching point, wherein the improvement comprises: an auxiliary shaft rotatably mounted in said frame, a first flexible drive means operatively coupling said auxiliary shaft to said drive shaft for rotating said auxiliary shaft in a timed angular relation therewith, a pitman, means mounted on said auxiliary shaft for oscillating said pitman in timed relation to the rotation of said auxiliary shaft, a rocker arm, means operatively connecting said pitman to said rocker arm to impart a rocking motion to said arm, linkage operatively connecting said rocker arm to said upper feed dog for rocking the same to provide feed advance and return motion thereto in timed relation with said needle reciprocation, a stud shaft rotatably mounted in said frame, eccentric means fast on said stud shaft, and a second flexible drive means operatively coupling said stud shaft to said auxiliary shaft for rotating said stud shaft in a timed angular relation therewith, said eccentric means operatively engaging said linkage to impart a lifting and dropping motion to said upper feed dog in timed relation to the reciprocation of said needle and its feed advance and return movements.

14. In a sewing machine as recited in claim 13 wherein said first flexible drive means comprises a pulley mounted on said drive shaft for rotation therewith, a first pulley mounted on said auxiliary shaft for rotation therewith, each of said pulleys having notches formed in the periphery thereof, and a continuous timing belt having teeth formed on the inner surface thereof and mounted about said drive shaft pulley and said first pulley with the teeth in meshing engagement with said notches, said second flexible drive means comprises a second pulley mounted on said auxiliary shaft for rotation therewith, a pulley mounted on said stud shaft for rotation therewith, each of said pulleys having notches formed in the periphery thereof, and a continuous timing belt having teeth formed on the inner surface thereof and mounted about said stud shaft pulley and said second pulley with the teeth in meshing engagement with said notches.

15. In a sewing machine as recited in claim 13 wherein said means operatively connecting said pitman to said

rocker arm comprises an upper feed regulating member, said member comprising a carrier frame pivotally mounted in said sewing machine frame, first link means pivotally secured at one extremity to said pitman and at a second extremity to said rocker arm, second link means pivotably secured at one extremity to said pitman and at a second extremity to said carrier frame, and means for pivoting said carrier frame in said sewing machine frame to change the position of the second extremity of the second link means relative to the second extremity of the first link means, thereby changing the stroke of said rocker arm and said upper feed dog advance and return movements.

16. In a sewing machine as recited in claim **14** wherein said means for oscillating said pitman comprises an eccentric mounted on said auxiliary shaft for rotation therewith, said pitman including an eccentric strap surrounding the periphery of said eccentric to be oscillated thereby, said linkage connecting the upper feed dog to said rocker arm including a quadratic link mechanism, said upper feed dog being secured to a first of said links, said first link being pivotably secured to a second and to a third of said links, a bellcrank lever, each said second and third links being further pivotably secured to one arm of said bellcrank lever, the second arm of said lever being biased into engagement with said stud shaft eccentric.

17. In a sewing machine as recited in claim **16** including a presser bar mounted in said head for selective endwise translation, a block mounted on said presser bar, said bellcrank being pivotably mounted to said block at the juncture of said second link, said rocker arm being operably connected to said first and second links at the juncture thereof so as to rock said linkage about said bellcrank pivot.

18. In a sewing machine as recited in claim **17** wherein said means operatively connecting said pitman to said rocker arm comprises an upper feed regulating member, said member comprising a carrier frame pivotably mounted in said sewing machine frame, first link means pivotally secured at one extremity to said pitman and at a second extremity to said rocker arm, second link means pivotably secured at one extremity to said pitman and at a second extremity to said carrier frame, and means for pivoting said carrier frame in said sewing machine frame to change the position of the second extremity of the second link means relative to the second extremity of the first link means, thereby changing the stroke of said rocker arm and said upper feed dog advance and return movements.

19. In a sewing machine as recited in claim **15** wherein said means for pivoting said carrier frame comprises a first shaft journaled in said bracket arm, a shifting lever fast on said shaft, means operatively connecting said shifting lever to said carrier frame for pivoting the same in said sewing machine frame when said shaft is turned, and means for turning said shaft.

References Cited

UNITED STATES PATENTS

3,099,974	8/1963	Chudner	112—207
3,162,158	12/1964	Chudner	112—207
3,262,410	7/1966	Chernes	112—212
3,540,391	11/1970	Haye	112—212

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,605,662 Dated September 20, 1971

Inventor(s) Erich M. Willenbacher, Karl-Heinz Michel and Werner J. Mayer

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 1, line 20 before "shaft" insert -- arm --;

Column 4, line 38 after "dog" insert -- 40 --;

Column 4, line 53 "72" should read -- 78 --;

Column 5, line 1 "pournaled" should read -- journaled --;

Column 8, line 59 delete "second link means";

Column 8, line 60 delete "pivotably secured at one extremity to said pitman and";

Column 8, line 61 delete "at a second extremity to said rocker arm,".

Signed and sealed this 21st day of March 1972.

(SEAL)
Attest:

EDWARD M.FLETCHER,JR.
Attesting Officer

ROBERT GOTTSCHALK
Commissioner of Patents